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Subject: Determination of Benzo(a)Pyrene and 2,3,7,8-TCDD TEQ Remedial Action Objectives, Legacy Site Services, East Plant, Riverview, MI

On behalf of Legacy Site Services, Inc., Environmental Standards, Inc. (Environmental Standards) has prepared this summary of the proposed dioxin (2,3,7,8-TCDD TEQ) and benzo(a)pyrene remedial action objectives for the East Plant property located in Riverview, Michigan. Upon your approval, these remedial action objectives will be included in the forthcoming Corrective Measures Study (CMS) for the East Plant site.

By way of background, the results of the 2004 US EPA-approved site-specific human health risk assessment for Legacy Site Services' East Plant property indicated that the risk levels for the maintenance worker incidental ingestion of surface soil scenario exceeded the United States Environmental Protection Agency's (US EPA's) *de minimis* 1×10^{-4} cancer risk benchmark. In the report, maintenance worker risks were assessed using soil sample results from the interval located 0.5 to 3.5 feet below ground surface (ft bgs); this interval was based on a logical break in the historical data that was available and the presence of root mat, crushed stone, and/or topsoil imported to the Site as clean fill in the uppermost soil horizon (0-0.5 ft bgs). The top 0.5 ft of cover is not representative of the surface soil conditions during the period of industrial activity. As such, historically, characterization sampling began at a depth of 0.5 ft bgs in order to obtain data from soils most likely impacted by historical industrial activities at the Site.

The two drivers of the maintenance worker risk level were 2,3,7,8-TCDD TEQ with a risk level of 2×10^{-4} for ingestion of surface soil and benzo(a)pyrene with a risk level of 1.3×10^{-5} for ingestion of surface soil. Consequently, an analysis was undertaken to determine remedial action objectives for 2,3,7,8-TCDD TEQ and benzo(a)pyrene in surface soil at the East Plant property.

Subsequent to the 2004 human health risk assessment, Legacy Site Services undertook an aggressive sampling program to further characterize dioxin and benzo(a)pyrene in surface soil at the East Plant. The additional characterization efforts focused on both targeting specific SWMU areas as well as characterizing dioxin and benzo(a)pyrene across the site using a sampling grid approach. For this characterization effort, surface soil samples were collected from the 0.5 to 2.5 ft interval, representing the interval of native soil most likely to be contacted by maintenance workers. This conservative interval accounts for the top 0.5 ft of root mat and/or crushed stone, and the underlying two feet of legacy material. The interval was chosen to ensure that the top two feet of original site soil was characterized.

The additional data generated by the supplemental characterization efforts greatly reduced the uncertainty associated with the previous historical data set for these two analytes and provided an indication of the levels of analyte concentrations that may be contacted by a maintenance worker across the site (as opposed to the results being biased to specific SWMUs). In addition to the use of historical data, the most recent data from the supplemental characterization efforts (conducted in 2006 and 2007) were incorporated into this analysis to reflect Legacy Site Services' current understanding of surface soil site conditions with respect to the two analytes of concern.

The 95% Upper Confidence Limit of the Mean Concentration (95% UCL) calculations discussed below were performed using US EPA's ProUCL (version 4.00.04), a statistical software package used to calculate UCL statistics. After testing the data set for a normal, lognormal, or gamma distributions, US EPA's ProUCL version 4.00.04 provides several UCL computation methods, both parametric and nonparametric. The non-parametric methods do not depend upon the data distributions. Based on the characteristics of the data set, ProUCL recommends a 95% UCL computation method that best represents the data.

2,3,7,8-TCDD TEQ

The establishment of a cleanup standard for 2,3,7,8-TCDD TEQ was based on information obtained during conversations between Legacy Site Services and the US EPA in conjunction with consideration of Michigan Department of Environmental Quality (MDEQ) Part 201 guidance and regulations.

The MDEQ Part 201 Generic Cleanup Criteria for the Industrial land use category is 0.99 ppb for 2,3,7,8-TCDD TEQ. Examples of the Industrial land use provided by MDEQ include manufacturing, utilities, industrial research, bulk petroleum storage, and other activities industrial in nature and with access reliably restricted by fences and/or security personnel. The East Plant property is currently deed restricted to limit land use to industrial-type activities, and an industrial land use is consistent with the current zoning of the property.

Legacy Site Services proposes to achieve a 0.99 ppb cleanup goal by placing a 2.0 ft cap (1.5 ft of common fill and 0.5 ft of topsoil) over portions of the East Plant property designated Areas A through H (Figure 1). In the dioxin data set, such capping was mimicked by replacing the concentrations of the sample locations designated for capping with a 2,3,7,8-TCDD TEQ concentration of 0.001 ppb to represent background dioxin concentrations that might be present in material brought in to cap the areas of interest.

A 95% UCL was then calculated to represent post-capping site conditions. The Pro-UCL recommended statistic (a 97.5% Kaplan-Meier Chebyshev UCL) of 0.997 ppb was used as the post-capping 95% UCL in this assessment (Attachment 1). This UCL corresponds to a maintenance worker risk level of 3×10^{-5} (using the same exposure assumptions and parameters as those used in the US EPA-approved 2004 risk assessment). This post-capping 2,3,7,8-TCDD TEQ risk level is well within US EPA's acceptable risk range of 1×10^{-6} to 1×10^{-4} , and the associated 95% UCL meets the MDEQ Industrial generic cleanup criteria for direct contact with soil. Accordingly, capping the proposed areas will address risks associated with 2,3,7,8-TCDD TEQ at the East Plant site.

Benzo(a)pyrene

The proposed capped areas described above and presented on Figure 1 were reflected in the benzo(a)pyrene data set by replacing benzo(a)pyrene results for sample locations situated below the capped areas with a concentration of 0.33 ppm to represent background concentrations that might be present in fill material brought in to cap the areas of interest. The 0.33 ppm value is the Target Detection Limit (TDL) provided by the MDEQ Remediation and Redevelopment Division (RRD) in its Operational Memorandum No. 2 (October, 2004). The incorporation of the 2006-2007 supplemental data and the "capping" of Areas A through H resulted in a 95% UCL of 7.268 ppm (a 97.5% Kaplan-Meier Chebyshev UCL) for benzo(a)pyrene (Attachment 2). Using the same exposure assumptions and parameters as those used in the 2004 US EPA-approved risk assessment and an exposure-point concentration of 7.268 ppm, the resultant maintenance worker risk level for benzo(a) pyrene was 9.8×10^{-6} . This risk level is well within US EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6} , and the associated 95% UCL (7.268 ppm) meets the MDEQ Industrial generic cleanup criteria for direct contact with soil of 8.0 ppm. Accordingly, capping the proposed areas will address risks associated with benzo(a)pyrene at the East Plant site.

Should you have any questions regarding the information presented above, please do not hesitate to contact me at 610-935-5577 or kzvarick@envstd.com. I look forward to working with you towards the successful completion of this project.

Sincerely,



Kathy Zvarick, LEED AP
Manager, Risk Assessment Services

Attachments

cc:

Mike Pinto, Legacy Site Services
Pete Swanson, Conestoga-Rovers & Associates

Attachment 1

ProUCL Output for 2,3,7,8-TCDD TEQ

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File W:\Legacy Site Services\CMS Support\20095449\DRAFT\UCL Data for 0.99 scenario_11_13_09
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

2,3,7,8-TCDD TEQ (ppb)

General Statistics

Number of Valid Data	246	Number of Detected Data	240
Number of Distinct Detected Data	95	Number of Non-Detect Data	6
		Percent Non-Detects	2.44%

Raw Statistics

Minimum Detected	0.000234
Maximum Detected	14.21
Mean of Detected	0.395
SD of Detected	1.552
Minimum Non-Detect	0.0001542
Maximum Non-Detect	0.964

Log-transformed Statistics

Minimum Detected	-8.36
Maximum Detected	2.654
Mean of Detected	-4.344
SD of Detected	2.924
Minimum Non-Detect	-8.777
Maximum Non-Detect	-0.0367

Note: Data have multiple DLs - Use of KM Method is recommended
 For all methods (except KM, DL/2, and ROS Methods),
 Observations < Largest ND are treated as NDs

Number treated as Non-Detect	229
Number treated as Detected	17
Single DL Non-Detect Percentage	93.09%

UCL Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.4
5% Lilliefors Critical Value	0.0572

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.322
5% Lilliefors Critical Value	0.0572

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.388
SD	1.534
95% DL/2 (t) UCL	0.55

Maximum Likelihood Estimate(MLE) Method N/A

MLE yields a negative mean

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.348
SD	2.937
95% H-Stat (DL/2) UCL	2.249

Log ROS Method

Mean in Log Scale	-4.417
SD in Log Scale	2.963
Mean in Original Scale	0.385
SD in Original Scale	1.534
95% Percentile Bootstrap UCL	0.56
95% BCA Bootstrap UCL	0.594

Attachment 1

ProUCL Output for 2,3,7,8-TCDD TEQ

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.213
Theta Star	1.848
nu star	102.5

A-D Test Statistic	22.3
5% A-D Critical Value	0.909
K-S Test Statistic	0.909
5% K-S Critical Value	0.0652

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	14.21
Mean	0.385
Median	0.001
SD	1.534
k star	0.195
Theta star	1.971
Nu star	96.09
AppChi2	74.48
95% Gamma Approximate UCL	0.497
95% Adjusted Gamma UCL	0.497

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.386
SD	1.531
SE of Mean	0.0978
95% KM (t) UCL	0.547
95% KM (z) UCL	0.547
95% KM (jackknife) UCL	0.547
95% KM (bootstrap t) UCL	0.649
95% KM (BCA) UCL	0.565
95% KM (Percentile Bootstrap) UCL	0.557
95% KM (Chebyshev) UCL	0.812
97.5% KM (Chebyshev) UCL	0.997
99% KM (Chebyshev) UCL	1.359

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.997
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Attachment 2

ProUCL Output for Benzo(a)Pyrene

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File WorkSheet.wst
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

BaP (ppm)

General Statistics

Number of Valid Data	222	Number of Detected Data	205
Number of Distinct Detected Data	107	Number of Non-Detect Data	17
		Percent Non-Detects	7.66%

Raw Statistics

Minimum Detected	0.019
Maximum Detected	55
Mean of Detected	3.946
SD of Detected	8.839
Minimum Non-Detect	0.33
Maximum Non-Detect	20

Log-transformed Statistics

Minimum Detected	-3.963
Maximum Detected	4.007
Mean of Detected	-0.196
SD of Detected	1.656
Minimum Non-Detect	-1.109
Maximum Non-Detect	2.996

Note: Data have multiple DLs - Use of KM Method is recommended
 For all methods (except KM, DL/2, and ROS Methods),
 Observations < Largest ND are treated as NDs

Number treated as Non-Detect	209
Number treated as Detected	13
Single DL Non-Detect Percentage	94.14%

UCL Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.346
5% Lilliefors Critical Value	0.0619

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic	0.182
5% Lilliefors Critical Value	0.0619

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.765
SD	8.551
95% DL/2 (t) UCL	4.712

Maximum Likelihood Estimate(MLE) Method N/A

MLE yields a negative mean

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.238
SD	1.644
95% H-Stat (DL/2) UCL	4.12

Log ROS Method

Mean in Log Scale	-0.276
SD in Log Scale	1.624
Mean in Original Scale	3.67
SD in Original Scale	8.546
95% Percentile Bootstrap UCL	4.62
95% BCA Bootstrap UCL	4.756

Attachment 2

ProUCL Output for Benzo(a)Pyrene

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.414
Theta Star	9.536
nu star	169.7

A-D Test Statistic	19.36
5% A-D Critical Value	0.841
K-S Test Statistic	0.841
5% K-S Critical Value	0.0675

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	55
Mean	3.673
Median	0.38
SD	8.547
k star	0.277
Theta star	13.26
Nu star	123
AppChi2	98.37
95% Gamma Approximate UCL	4.592
95% Adjusted Gamma UCL	4.598

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	3.681
SD	8.529
SE of Mean	0.574
95% KM (t) UCL	4.63
95% KM (z) UCL	4.626
95% KM (jackknife) UCL	4.63
95% KM (bootstrap t) UCL	4.824
95% KM (BCA) UCL	4.773
95% KM (Percentile Bootstrap) UCL	4.66
95% KM (Chebyshev) UCL	6.184
97.5% KM (Chebyshev) UCL	7.268
99% KM (Chebyshev) UCL	9.395

Potential UCLs to Use

97.5% KM (Chebyshev) UCL 7.268